The Thermodynamics of a Ramjet

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Fig. 1: A NACA engineer cleaning a Ramjet circa. 1950 [1]

I. Introduction

A Ramjet is an airbreathing engine that compresses air through a choke point without using active compression. As such, it requires to already be moving at speed to function. A typical ramjet operates from speeds of Mach 3 to Mach 6. This report will analyse a Ramjet through the lens of thermodynamics, using idealised Brayton cycles to dissect the sections of the jet and the state variables at each section.

II. The Brayton Cycle and The Ramjet

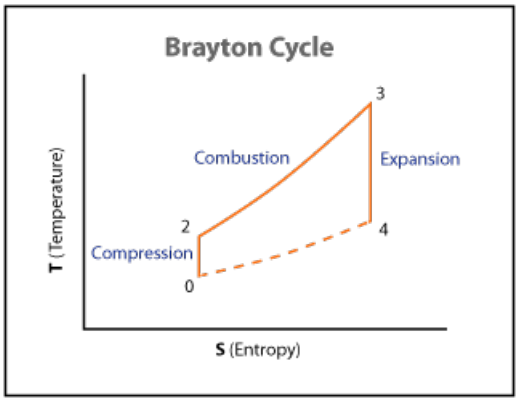

Fig. 2: An idealised Brayton Cycle [2]

A. Inlet and Compressor

B. Combustor

C. Turbine and Nozzle

D. Heat Rejection to Atmosphere

III. Conclusion

References

[1] "Naca technician cleans a ramjet in 8- by 6-foot supersonic wind tunnel." [Online]. Available: https://images.nasa.gov/details-GRC-1950-C-25677?fbclid=IwAR1I4lLNCj8oFRWki7opYtk2FaSyQSROFKWyJmHVG05pxn6B_ouRdWINMkY

[2] "Jet propulsion/thermodynamic cycles." [Online]. Available: https://en.wikibooks.org/wiki/Jet_Propulsion/Thermodynamic_Cycles?fbclid=IwAR2LLB9xj9sYifgvgjftlIzhw5BSKzmoTz6c3fQtq5W_v2dpcKOOxem0cEE